

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Withdrawn) A mass transfer system comprising:
 - (a) a housing for carrying a first fluid and defining a first fluid flow path; and
 - (b) at least one selectively fluid-permeable element defining a second fluid path, said element adapted to move relative to the flow of said first fluid, the selectively fluid-permeable element carrying a second fluid, which second fluid may pass through said selectively fluid-permeable element and thereby contact said first fluid within the first fluid path, resulting in a fluid exchange between the first and second fluids as the first fluid flows through the housing.
2. (Withdrawn) The mass transfer and pump apparatus of Claim 1, further comprising an agitator for moving the at least one selectively fluid-permeable element relative to the housing.
3. (Withdrawn) The mass transfer and pump apparatus of Claim 2, wherein the selectively fluid-permeable element is oriented substantially perpendicular to the bulk flow of the first fluid.
4. (Withdrawn) The mass transfer and pump apparatus of Claim 1, wherein said selectively fluid-permeable element is in fluid connection with a distributor element, and said distributor element comprises:
 - (a) a shaft defining a fluid inlet path and a fluid exit path;
 - (b) an inner ring;
 - (c) an outer ring concentrically spaced with respect to the inner ring such that the inner ring and the outer ring define a gas supply plenum and a gas return plenum;
 - (d) a fluid supply spoke having a inlet end in fluid communication with the fluid inlet path and a outlet end in fluid communication with the gas supply plenum; and
 - (e) a fluid return spoke having an outlet end in fluid communication with the fluid exit path and an inlet end in fluid communication with the gas return plenum.

5. (Withdrawn) The mass transfer and pump apparatus of Claim 4, wherein the selectively fluid-permeable element is positioned between the inner ring and the outer ring.

6. (Withdrawn) The mass transfer and pump apparatus of Claim 4, wherein said distributor element includes a plurality of selectively fluid-permeable membrane elements.

7. (Withdrawn) The mass transfer and pump apparatus of Claim 6, wherein the plurality of selectively fluid-permeable membrane elements are positioned in at least two layers, the elements of one layer being positioned non-parallel relative to elements in the other layer.

8. (Withdrawn) The mass transfer and pump apparatus of Claim 6, wherein each of the selectively fluid-permeable membrane elements are permeable to gas and impermeable to liquid.

9. (Withdrawn) The mass transfer and pump apparatus of Claim 1, further comprising a heat exchanger to alter the temperature of one of the first fluid and the second fluid.

10. (Withdrawn) The mass transfer and pump apparatus of Claim 9, wherein the heat exchanger is a fluid impermeable member defining a fluid path for a third fluid, the fluid impermeable member in fluid communication with the one distributor element.

11. (Withdrawn) The mass transfer and pump apparatus of Claim 4, wherein the distributor element comprises:

- (a) a shaft defining a fluid inlet path, a fluid exit path, a gas inlet path and a gas exit path;
- (b) an inner ring having a first face and a second face, the inner ring defining a circular opening;
- (c) an outer ring concentrically spaced with respect to the inner ring

(d) a plurality of dividers extending between the outer ring and the inner ring such that a heat exchange fluid supply plenum, a fluid heat exchange return plenum, a gas supply plenum and a gas return plenum are defined by the inner ring, the outer ring and the plurality of dividers;

(e) a fluid supply spoke having a inlet end in fluid communication with the fluid inlet path and a outlet end in fluid communication with the fluid supply plenum;

(f) a fluid return spoke having an outlet end in fluid communication with the fluid, exit path and a inlet end in fluid communication with the fluid return plenum;

(g) a gas supply spoke having a inlet end in fluid communication with the gas inlet path and a outlet end in fluid communication with the gas supply plenum;

(h) a gas return spoke having an outlet end in fluid communication with the gas outlet path and a inlet end in fluid communication with the gas return plenum;

(i) a plurality of fluid-impermeable membrane elements extending across the circular opening of the inner ring and between the inner ring and the outer ring, the plurality of fluid-impermeable membrane elements being in fluid communication with the fluid supply plenum and the fluid return plenum; and

wherein the plurality of selectively fluid-permeable membrane elements are in fluid communication with the gas supply plenum and the gas return plenum.

12.-17. (Canceled)

18. (Withdrawn) A mass transfer apparatus comprising:

(a) a housing defining a first fluid path;

(b) at least one distributor element within the housing and adapted for movement relative to the housing; and

(c) a plurality of selectively fluid-permeable membrane elements each defining a second fluid path and attached to the at least one distributor element, wherein when the at least one distributor element moves relative to the housing, the plurality of selectively fluid-permeable membrane elements carrying a second fluid contact a first fluid within the first fluid path resulting in a fluid exchange between the first and second fluids.

19. (Canceled)
20. (Withdrawn) An apparatus for hemodialysis comprising:
- (a) a housing defining a blood flow path and having a blood inlet, a blood outlet, a dialysis fluid inlet and a dialysis fluid outlet;
 - (b) fluid outlet path wherein the double lumen shaft dialysis fluid inlet path is in fluid communication with the housing dialysis fluid inlet and the double lumen shaft dialysis fluid outlet is in fluid communication with the housing dialysis fluid outlet;
 - (c) at least one distributor element mounted on the double lumen shaft and defining a blood flow path, the at least one distributor element having:
 - (i) an outer ring with a first and second face;
 - (ii) an outer ring cap concentrically spaced with respect to the outer ring such that the outer ring and outer ring cap define an dialysis fluid supply plenum and an dialysis fluid return plenum,
 - (iii) a first hollow spoke in fluid communication with the dialysis fluid inlet path and the dialysis fluid supply plenum.
 - (iv) a second hollow spoke in fluid communication with the dialysis fluid path and the dialysis fluid return plenum; and
 - (v) a plurality of selectively semi-permeable membrane elements extending across the distributor disk blood path and each of the plurality of selectively permeable membrane elements in fluid communication with the dialysis fluid supply plenum and the dialysis fluid return plenum; and wherein when blood flows through the housing flow path and the dialysate flows through the plurality of selectively fluid permeable membrane elements and when the at least one distributor element rotates about the at least one double lumen shaft, metabolic waste products from the blood diffuse into the dialysate which simultaneous heating and pumping of the blood occurs.
21. (Canceled)
22. (Original) An apparatus for liver assist comprising:

(a) a housing defining a blood flow path and having a blood inlet, a blood outlet, a liver-assist fluid inlet and a liver-assist fluid outlet;

(b) a double lumen shaft defining a liver-assist fluid inlet path and a liver-assist fluid outlet path wherein the double lumen shaft liver-assist fluid inlet path is in fluid communication with the housing liver-assist fluid inlet and the double lumen shaft liver-assist fluid outlet is in fluid communication with the housing liver-assist fluid outlet;

(c) at least one distributor element mounted on the double lumen shaft and defining a blood flow path, the at least one distributor element having:

(i) an outer ring with a first and second face;

(ii) an outer ring cap concentrically spaced with respect to the outer ring such that the outer ring and outer ring cap define a liver-assist fluid supply plenum and a liver-assist fluid return plenum;

(iii) a first hollow spoke in fluid communication with the liver-assist fluid inlet path and the liver-assist fluid supply plenum;

(iv) a second hollow spoke in fluid communication with the liver-assist fluid path and the liver-assist fluid return plenum; and

(v) a plurality of selectively semi-permeable membrane elements extending across the distributor disk blood path and each of the plurality of selectively permeable membrane elements in fluid communication with the liver-assist fluid supply plenum and the liver-assist fluid return plenum; and wherein when blood flows through the housing flow path and the dialysate flows through the plurality of selectively fluid permeable membrane elements and when the at least one distributor element rotates about the at least one double lumen shaft, metabolic waste products from the blood diffuse into the dialysate which simultaneous heating and pumping of the blood occurs.